

REMARKS/ARGUMENTS

Claims 11-14, 16 and 17 remain pending herein.

The Applicants thank Examiner Patel for the courtesies extended during a telephone interview conducted on April 28, 2004. The substance of the discussion during that interview is incorporated in the following remarks.

During the course of the April 28, 2004 interview, Examiner Patel stated that he had intended to include in the Final Rejection a rejection of claim 11 under 35 U.S.C. §112, first paragraph concerning the expressions "such as a capacitor element", "and/or" and "such as an electromechanical conversion element" in claim 11. The above amendments consist of changes to address these concerns of the Examiner. Accordingly, since the above amendments eliminate concerns raised by the U.S. PTO, and since those concerns were not stated in the Final Rejection or in the previous Office Action mailed March 24, 2003, it is respectfully submitted that entry of the amendments set forth above would be proper under 37 C.F.R. 1.116. Accordingly, entry of the above amendments is respectfully requested.

The drawings were objected to. The Office Action contains a statement regarding the cross-hatching pattern shown for the masking film 72 in Figs. 9A and 9B. It is respectfully noted that the materials out of which the masking film 72 can be constructed include metals. Accordingly, it is respectfully submitted that the solid-line cross-hatching in the masking film 72 depicted in Figs. 9A and 9B is appropriate under 37 C.F.R. and the MPEP. Accordingly, it is respectfully requested that the U.S. PTO reconsider and withdraw this objection.

Claims 12, 13, 14 and 17 were rejected under 35 U.S.C. §112, second paragraph.

It is respectfully noted that the specification, page 3, lines 8-26 describes that using conventional screen printing techniques, it has been difficult to form a gap of not more than 40 μm between patterns, and that a method has been employed in which different parts of the

overall pattern have been made by performing screen printing several times in a divided manner. The specification further describes that using such a plurality of screen printing procedures, however, the film thickness of the pattern formed by the "odd-numbered screen printing process" has been seen to differ from the film thickness of a pattern formed by an "even-numbered screen printing process" by 10% or more. The meaning of such disclosure is that in one of the screen printing procedures, the odd-numbered patterns are formed, and in the other screen printing process, the even-numbered patterns are formed, and the even-numbered and odd-numbered patterns are aligned with one another such that they alternate (i.e., even-numbered patterns are positioned between odd-numbered patterns and odd-numbered patterns are positioned between even-numbered patterns).

The present specification further discloses, e.g., at page 17, lines 15-25, that according to the present invention, contrary to the prior art, an entire pattern can be formed by a single screen printing procedure, even though printed elements are spaced from one another by a gap of not more than 40 μm . The specification further discloses that where a plurality of patterns are formed according to the present invention in an aligned manner, the elements in the overall pattern which would have been formed by an odd-numbered operation (in a two-printing step procedure according to the prior art) have an average thickness which differs, by not more than 5% of the overall average thickness, from the average thickness of elements of the overall pattern which would have been formed by an even-numbered operation (in a two-printing step procedure of the prior art). That is, the specification discloses that "even-numbered patterns" and odd-numbered patterns" are those elements of the overall pattern which would have been formed by one or the other, respectively, of the printing steps if a two-step screen printing process of the prior art were used to print the patterns. The

expression "aligned manner" indicates that the respective elements corresponding to the even-numbered patterns and the odd-numbered patterns are aligned with one another.

Also, it is respectfully noted that claims 13 and 14 are product-by-process claims. In addition, claim 13 recites that each of the screen printed patterns comprising a printing ink material applied on the substrate.

In view of the above, it is respectfully requested that the U.S. PTO reconsider and withdraw this rejection.

Claims 11-14, 16 and 17 were rejected under 35 U.S.C. §103(a) over U.S. Patent No. 6,041,496 (Haq '496) in view of U.S. Patent No. 6,047,893 (Nakata '893). In addition, claims 12 and 17 were rejected under 35 U.S.C. §103(a) over Haq '496, Nakata '893 and U.S. Patent No. 5,624,782 (Hayakawa '782).

As discussed during the April 28, 2004 telephone interview, submitted herewith is a reference from du Pont® (one copy is more clean and the other copy includes more English-language translation of Japanese text) which includes information which demonstrates that a pattern formed by screen-printing structurally differs from patterns formed by other methods, e.g., photolithography. In particular, the page entitled "Line Resolution, Fodel® vs Screen Printing" clearly shows the difference between a screen-printed pattern and a pattern formed by photolithography.

The Office Action contains an acknowledgment that Haq '496 does not disclose a gap between screen-printed patterns of not more than 40 μm . Nakata '893 is apparently relied on in the Office Action for alleged disclosure of forming a wiring pattern having a line spacing as small as 15 μm . It is respectfully submitted that neither Haq '496 nor Nakata '893, nor any combination thereof, discloses or suggests a circuit board comprising a plurality of screen-printed patterns formed on a substrate, a gap disposed between the plurality of screen-printed

patterns being not more than 40 μ m. Moreover, it is respectfully submitted that neither Haq '496 nor Nakata '893 contains disclosure which would enable one of skill in the art to produce such a structure. Hayakawa '782 is apparently relied on in the Office Action for alleged disclosure of uniformity of thickness of patterns.

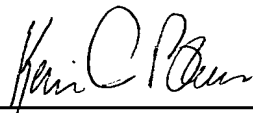
Accordingly, such disclosure in Hayakawa '782 would not overcome the shortcomings of Haq '496 and Nakata '893 as attempted to be applied against claim 11. Accordingly, it is respectfully requested that the U.S. PTO reconsider and withdraw these rejections.

In view of the above, claims 11-14, 16 and 17 are in condition for allowance.

If the Examiner believes that contact with Applicants' attorney would be advantageous toward the disposition of this case, the Examiner is herein requested to call Applicants' attorney at the phone number noted below.

The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 50-1446.

Respectfully submitted,



Kevin C. Brown
Reg. No. 32,402

April 30, 2004

Date

KCB:jms
Enclosure:
du Pont® Reference

BURR & BROWN
P.O. Box 7068
Syracuse, NY 13261-7068

Customer No.: 025191
Telephone: (315) 233-8300
Facsimile: (315) 233-8320

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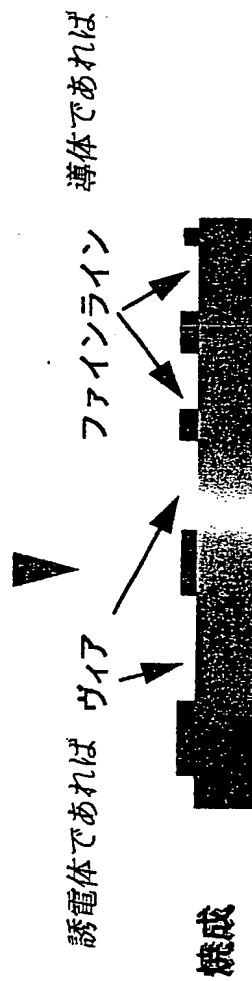
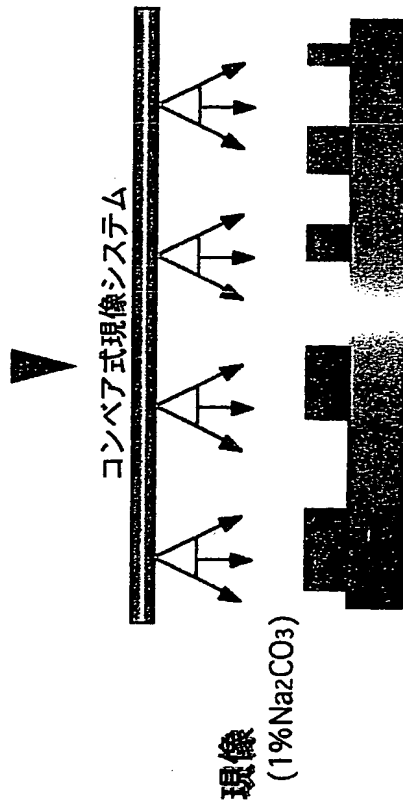
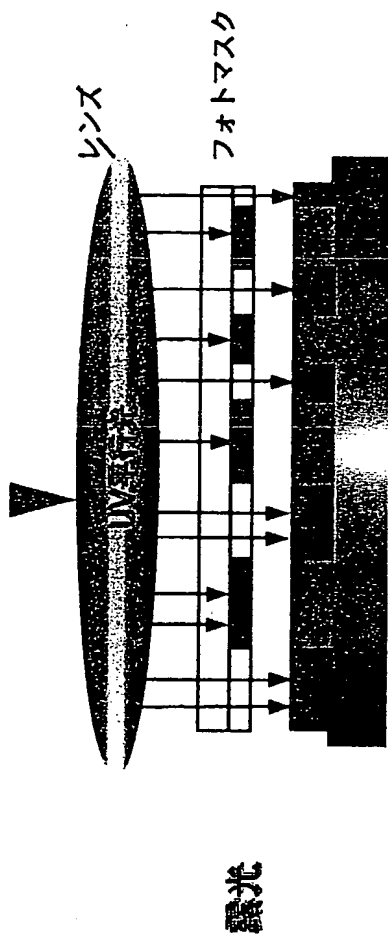
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フォードル® プロセス

スクリーン印刷
乾燥 (80℃)



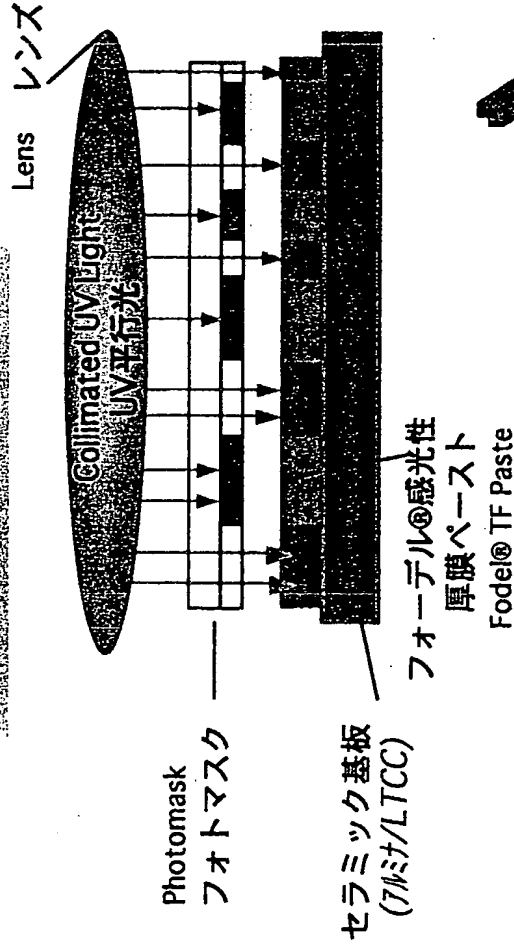
DUPONT®

Fodel® Process Equipments (設備/装置)

＜露光機＞



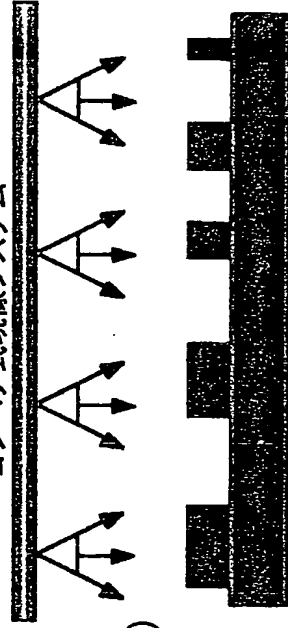
Exposure (露光)



＜現像機＞

Development (現像)

Coveyized Developer System
コンベア式現像システム



0.4% Na₂CO₃, 30°C
(Sodium carbonate)

DU PONT®

フォデール®(Fodel®)推奨条件(Standard Process)

Fodel ® Pt/Ag Platable Conductor

プロセス Process	推奨条件 Recommendation	注釈 Remarks
乾燥膜厚 Dried Thickness	12~18 μ m	スクリーン印刷 Screen Printing
レベリング Leveling	10min	室温 at Room Temp.
乾燥 Drying	80°C/20min	ボックス炉 Drying Oven
露光 Exposure	600~1,000mj/cm ²	水銀又は水銀/キセノンランプによるUV光(365nm) Hg or Hg/Xe UV Light(λ_{max} : 365nm)
現像 Development	TTC * X 1.2~2.0	0.4%炭酸ナトリウム水溶液(30°C) 0.4% Na ₂ CO ₃ (Sodium carbonate) 30°C
焼成 Firing	850°C/10min(Peak)	ベルト炉 Conventional Belt Furnace

*) TTC : Total Time to Clean



フォデル®(Fodel®)特性比較 (Performance)

Fodel ® Pt/Ag Platable Conductor(K3714)

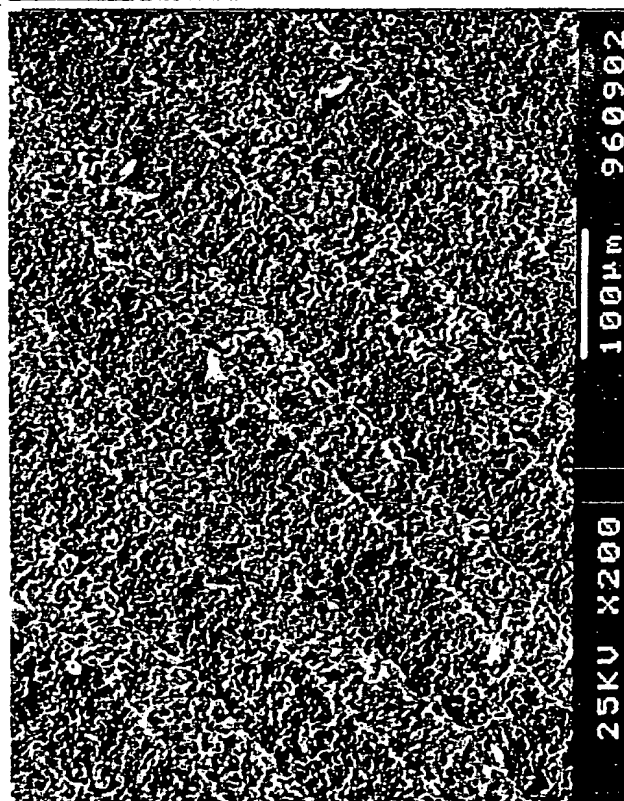
vs

Screen Print Low Temp. Cu 6002F

	Process	Fodel K3714	Pt/A	Low Temp. Cu 6002F
プロセス		フォト		スクリーン印刷
ファインライン性 Fine Line (ライン/スペース) (Line/Space)		30 μ m/30 μ m		75 μ m/75 μ m
シート抵抗 Sheet Resistivity (@5 μ m Fired)		\approx 5m Ω /□ (@5 μ m Fired)		\approx 4m Ω /□ (@16 μ m Fired)
接着強度 Adhesion (on 96% Al ₂ O ₃)	初期値 Initial	\geq 30 (N)		\geq 30 (N)
	イ-ジ-ング 後 150°C/48hr	\geq 30 (N)		\geq 30 (N)



従来のFodel® Pt/Ag 導体



X 200

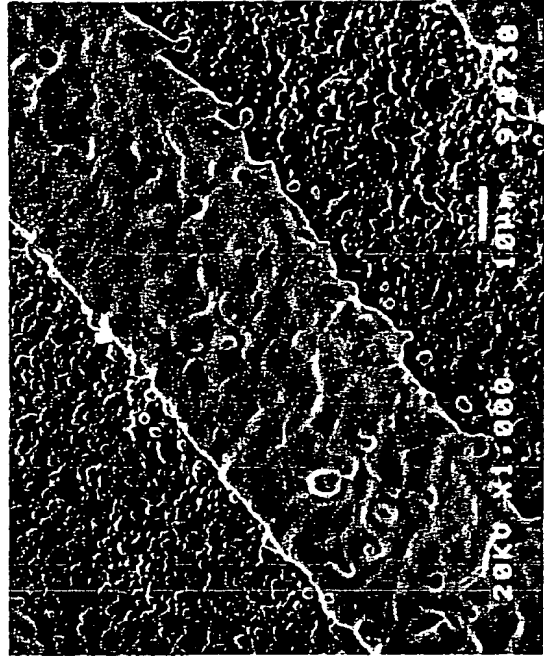
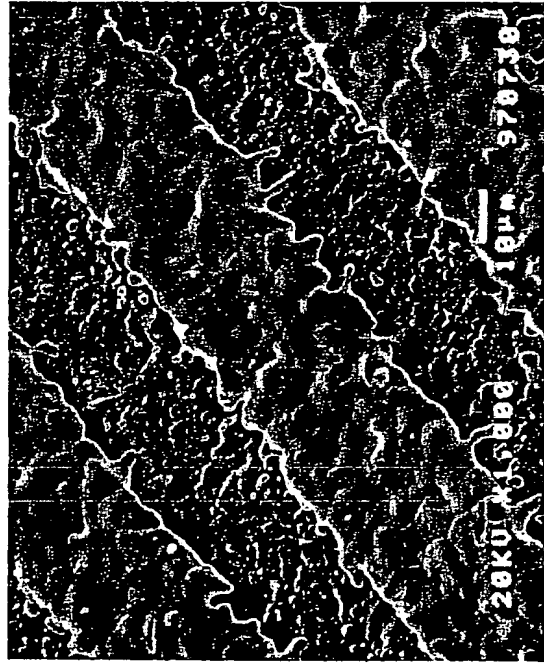


X 1,000

アルミナ基板上

DUPONT®

Fodel® Pt/Ag マッパ下地(Platable Conductor) (焼成面 : Fired Surface)



On Alumina

30μm/30μm ライン&スペース(L&S)

50μm/50μm L&S

DUPONT®

Line Resolution(ライン解像度)

Fodel® vs Screen Printing

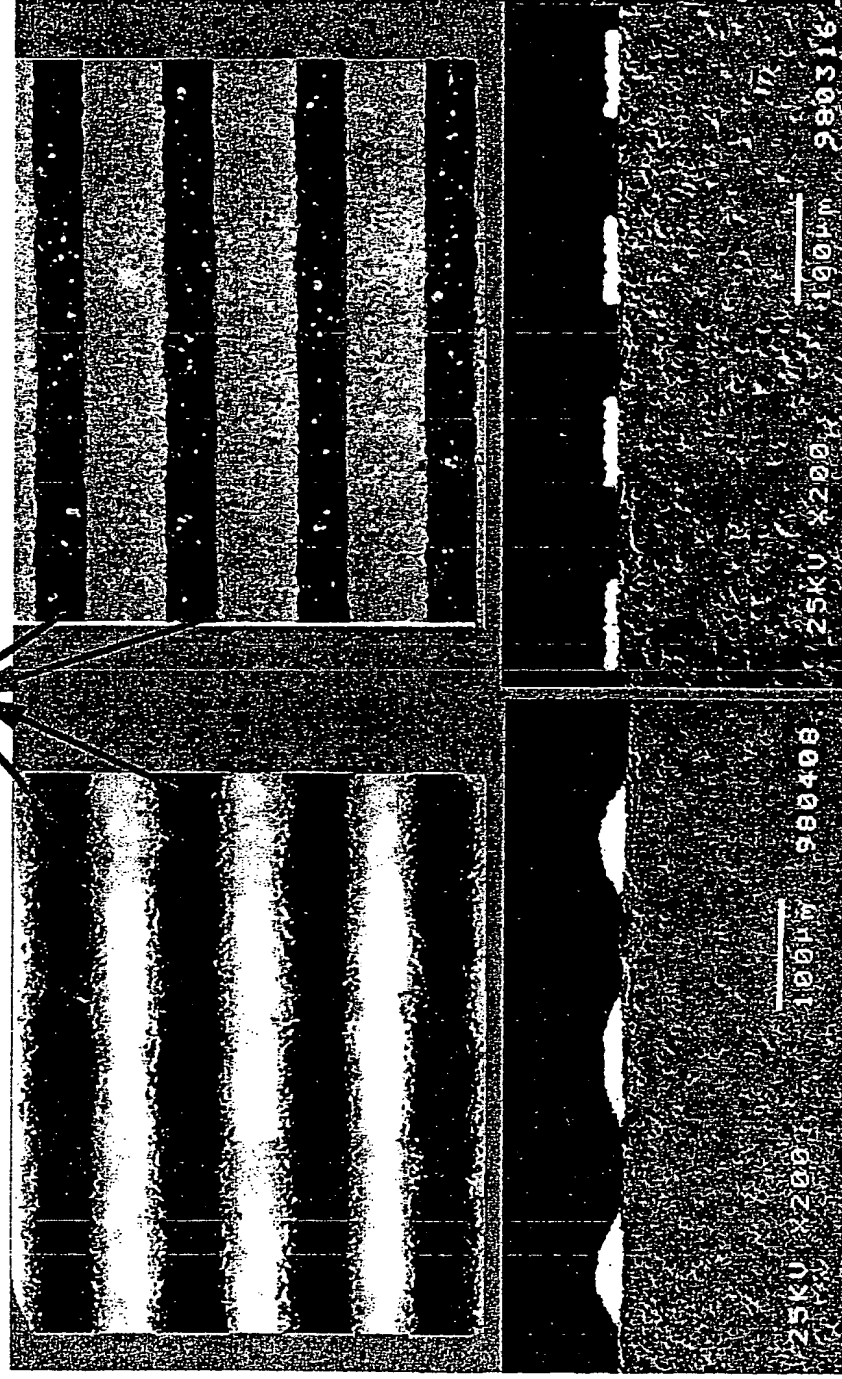
スクリーン印刷
(Screen Printing)

フォデル® (Fodel®)

6002F~Low Temp. Cu

Lines

Fodel® Platable Pt/Ag



Top View
Back Light

50 µm W

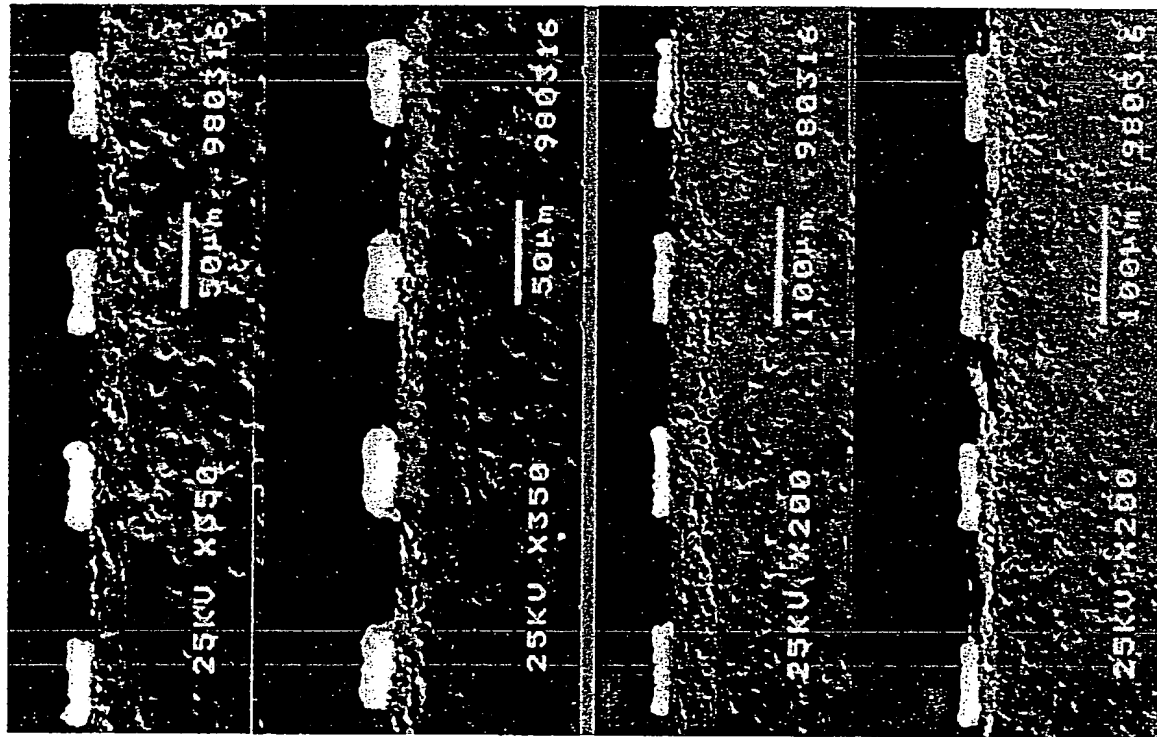
X-Section

75 µm W

DUPONT®

Fodel® Pt//Ag

Cross Section (断面図)



● 35 μ m Fired Width
(焼成巾)
On Alumina
(アルミナ基板上)

● 35 μ m Fired Width
(焼成巾)
On 6050 Diel
(誘電体上)

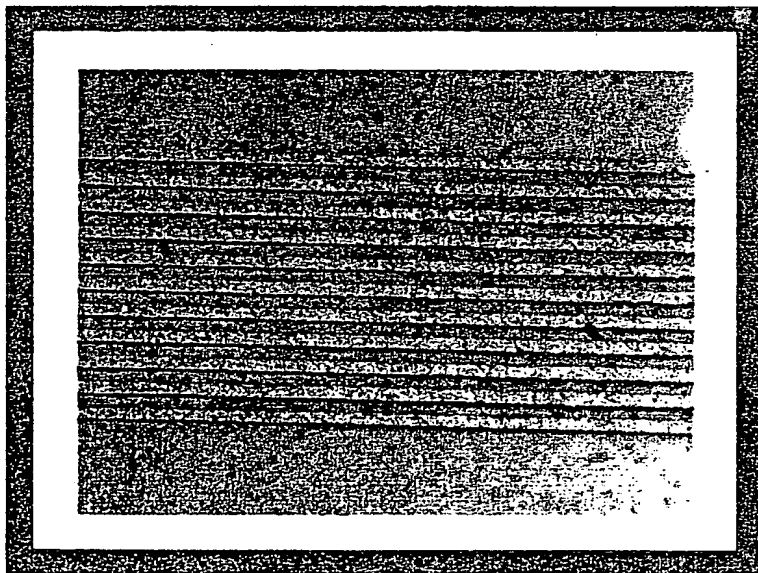
● 75 μ m Fired Width
(焼成巾)
On Alumina
(アルミナ基板上)

● 75 μ m Fired Width
(焼成巾)
On 6050 Diel
(誘電体上)

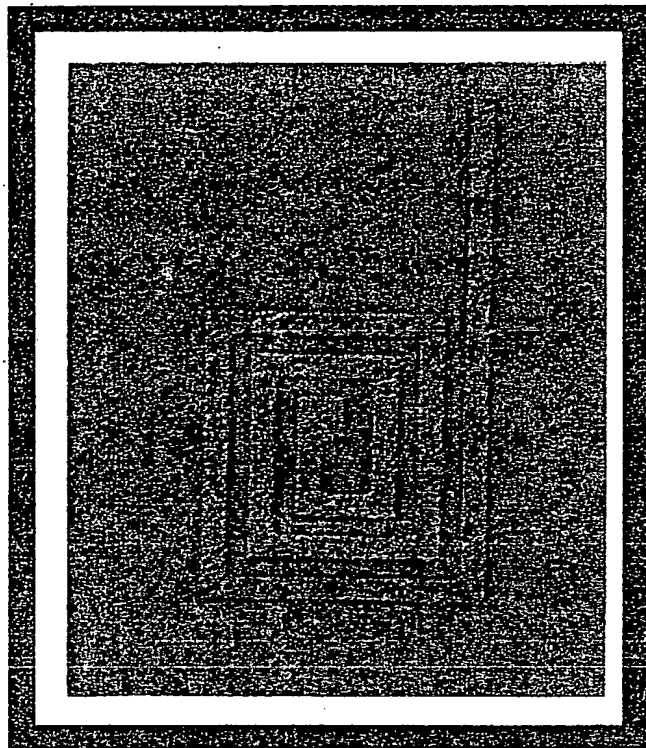
All: Fired
Thickness
6~7 μ m

DUPONT®

**Future Trends -
Co-fired Photo Imageable Silver
Fodel® on Green Tape™**



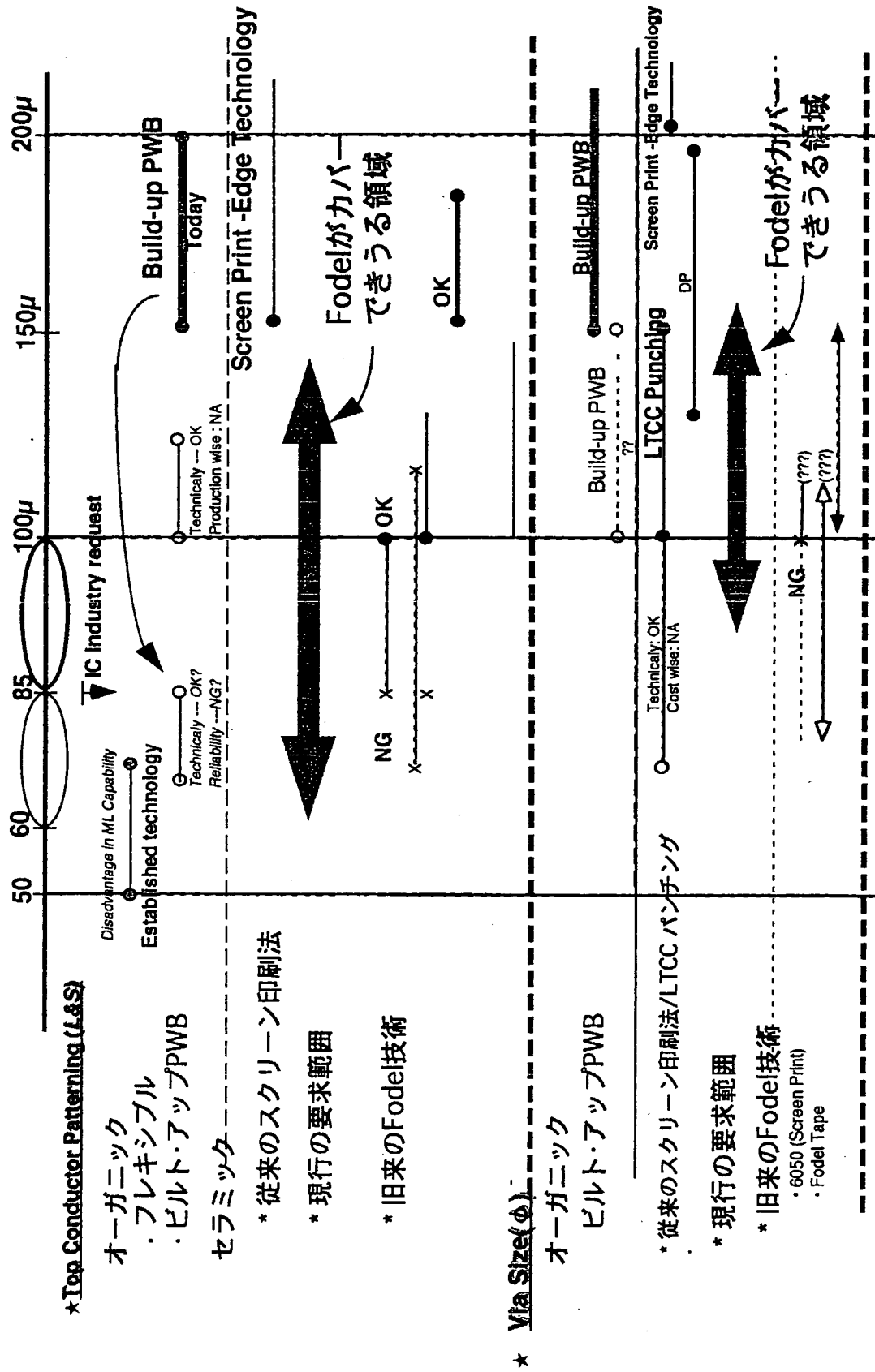
50X view of
50 μ m Lines and Spaces
Co-Fired Ag Fodel® On 951



50X View of
80 μ m Inductor Coil

DUPONT®

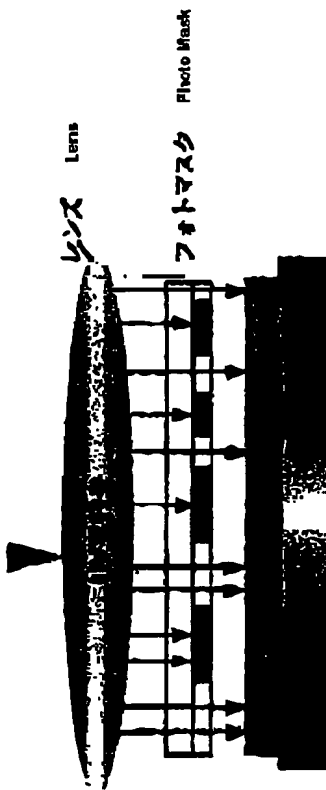
Fodel® Study on Pitch / Via Size 市場のピッチ&ビアサイズ・スタディー



FODEL
スクリーン印刷機
プロセス
フロー

Screen Printing
スクリーン印刷機
乾燥 (80°C)
Dry Heat

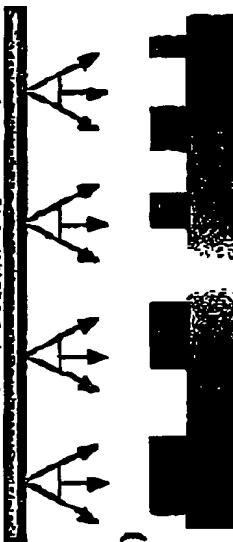
ペースト Paste
基板 Substrate



Exposure
露光

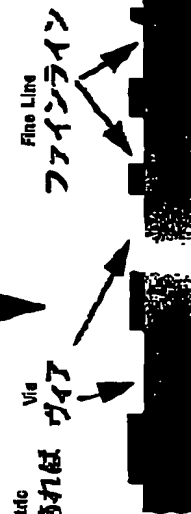
Conveyor Type Developer System

コンベア式現像システム



Development
現像
(1% Na₂CO₃)

If a conductor
導体であれば



If a dielectric
誘電体であれば
Via
ビア

Firing
焼成

DUPONT®

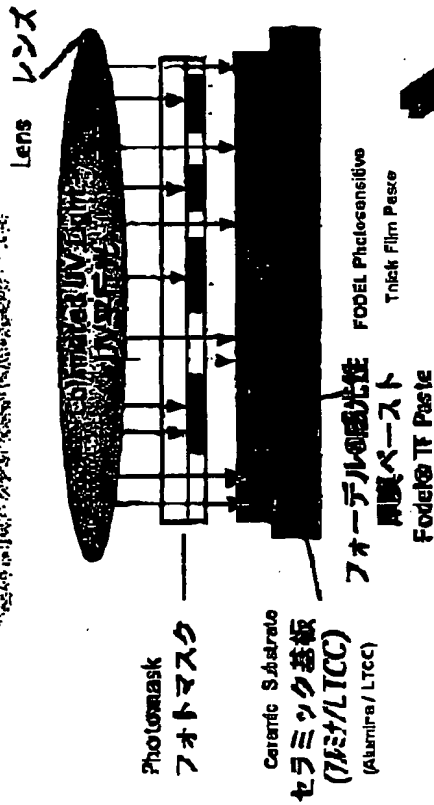
Fodel® Process Equipments (装置/装置)

(Equipment / Apparatus)

<露光機>



Exposure (露光)

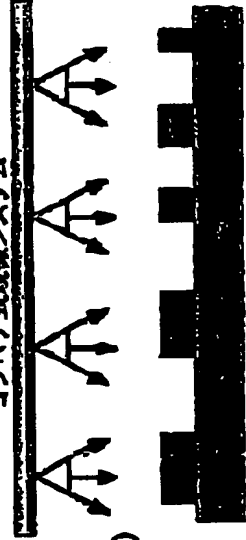


<現像機>

< Developing Apparatus >

Development (現像)

Conveyorized Developer System
コンベア式現像システム



0.4% Na₂CO₃, 30°C
(Sodium carbonate)

DU PONT®

FODEL

Recommended Conditions

フォデル®(Fodel®)製造条件(Standard Process)

Fodel ® Pt/Ag Platable Conductor

プロセス Process	推奨条件 Recommendation	注釈 Remarks
乾燥膜厚 Dried Thickness	12~18 μ m	スクリーン印刷 Screen Printing
レベルング Leveling	10min	室温 at Room Temp.
乾燥 Drying	80℃/20min	ボックス炉 Drying Oven
露光 Exposure	600~1,000mj/cm ²	水銀又は水銀/キセノンランプによるUV光(365nm) Hg or Hg/Xe UV Light(λ_{max} : 365nm)
現像 Development	TTC * X 1.2~2.0	0.4%炭酸ナトリウム水溶液(30℃) 0.4% Na ₂ CO ₃ (Sodium carbonate) 30℃
焼成 Firing	850℃/10min(Peak)	ベルト炉 Conventional Belt Furnace

*) TTC : Total Time to Clean



Comparative Characteristics

フォデル®(Fodel®)特性比較 (Performance)

Fodel® Pt/Ag Platable Conductor(K3714)

VS

Screen Print Low Temp. Cu 6002F

Screen Print 9

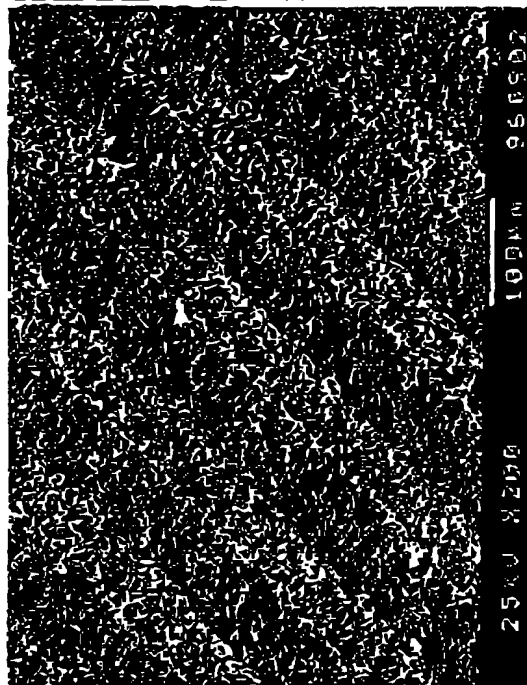
プロセス Process		Fodel K3714	Pt/A	Low Temp. Cu 6002F
ファインライン性 Fine Line (ライン/スペース) (Line/Space)		フォト Plating		スクリーン印刷
シート抵抗 Sheet Resistivity (@5μm Fired)		30μm/30μm		75μm/75μm
Adhesive Strength 接着強度		≈ 5mΩ/□ (@5μm Fired)		≈ 4mΩ/□ (@16μm Fired)
Adhesion (on 96% Al ₂ O ₃)	初期値 Initial	≥ 30 (N)		≥ 30 (N)
	I-ダング後 150°C/48hr	≥ 30 (N)		≥ 30 (N)

After Edging

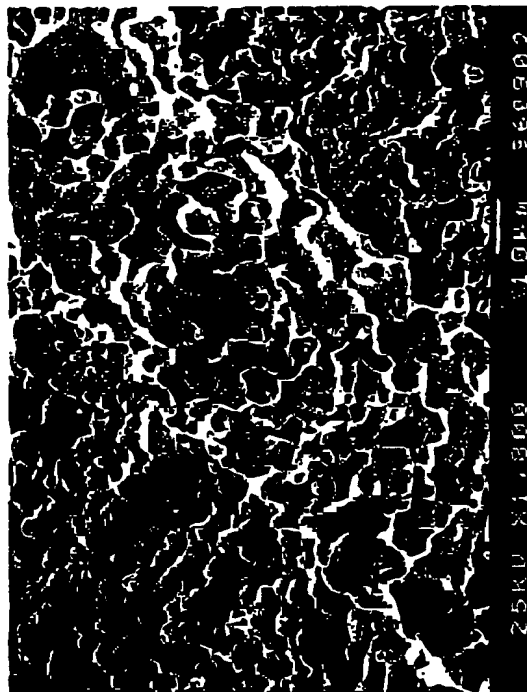


Former FODEL Pt/Ag Conductor

従来のFodel® Pt/Ag 導体



X 200



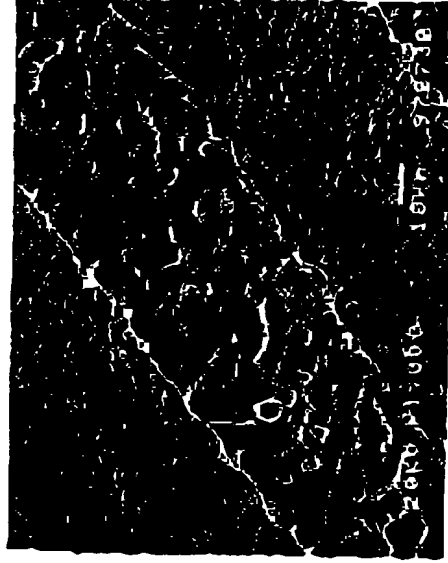
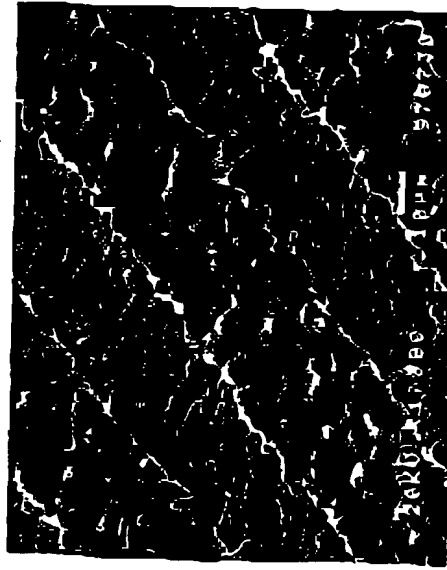
X 1,000

アルミナ基板上
On Alumina Substrate



FODEL 2/Ag Plating Undercoat

Fodel 2 PVAg マッキ下地 (Platable Conductor) (焼成面 : Fired Surface)



On Alumina

30μm/30μm 30μm/50μm L&S

Line & Space

50μm/50μm L&S

DUPONT®

Line Resolution(ライン解像度)

Fodel® vs Screen Printing

スクリーン印刷
(Screen Printing)

フォデル® (Fodel®)

6002F~Low Temp. Cu

Lines

Fodel® Platable Pt/Ag

Top View
Back Light

50 μ m W

X-Section

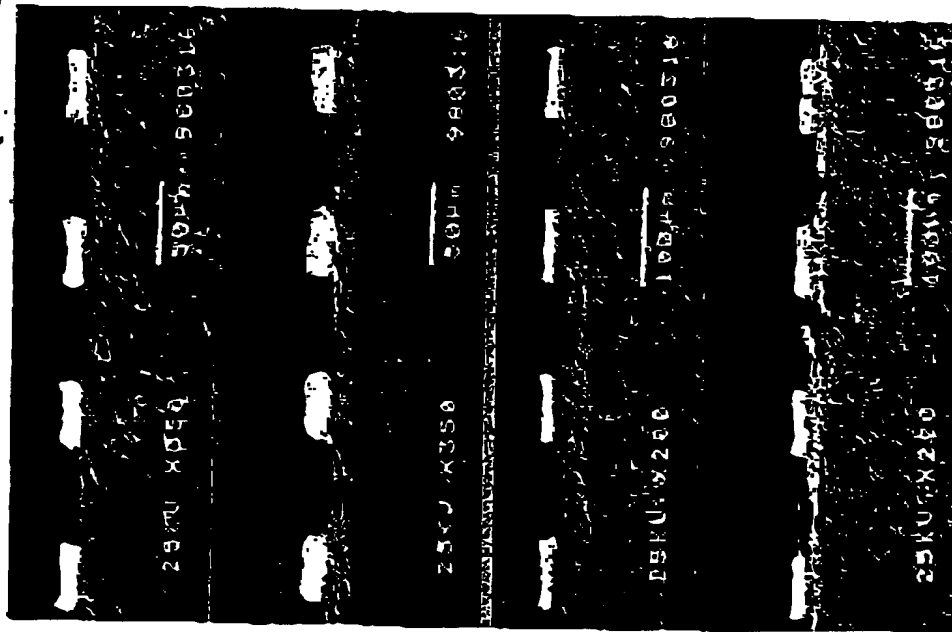
75 μ m W



DUPONT®

Fodel® Pt/Ag

Cross Section (断面図)



● 35 μ m Fired Width
(焼成巾)
On Alumina
(アルミナ基板上)

● 35 μ m Fired Width
(焼成巾)
On 6050 Die
(誘電体上)

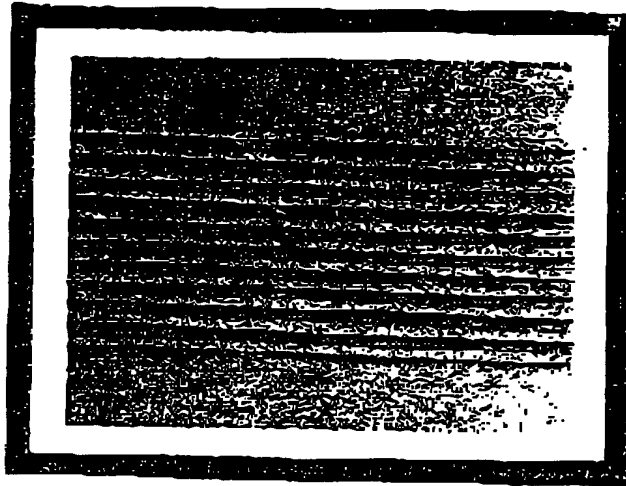
● 75 μ m Fired Width
(焼成巾)
On Alumina
(アルミナ基板上)

● 75 μ m Fired Width
(焼成巾)
On 6050 Die
(誘電体上)

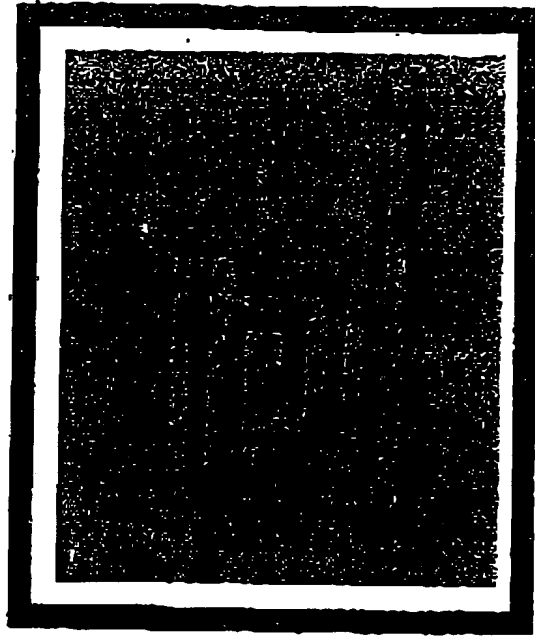
All: Fired
Thickness
6~7 μ m



**Future Trends -
Co-Fired Photo Imageable Silver
Fedelt[®] on Green Tape[™]**



**50X view of
50 μ m Lines and Spaces
Co-Fired Ag Fedelt[®] On 951**



**50X View of
80 μ m Inductor Cell**

DUPONT[®]

Fodel® Study on Pitch / Via Size 市場のピッチ&ビアサイズ・スタディー

Study of Pitch and Via Size in the Marketplace

